FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 76 Thursday, June 7, 1945 No. 1503

Castings in Architecture

The efforts made by the Council and Director of the British Cast Iron Research Association to reawaken the interest of architects in cast iron as a medium for the expression of their art has borne fruit, as the May issue of the " Official Architect " is entirely devoted to this subject. From a study of this magazine, the foundryman can draw a number of useful conclusions. It is obvious that a certain amount of confusion still exists in the minds of some architects as to nomenclature, and we find the use of the word " mould " when a " pattern " is obviously what is meant. This points to the need of a better understanding of the fundamental processes of making castings by the " man in the street," which must emanate from the industry. On the other side of the picture, the foundryman should have more than a nodding acquaintance with architecture if he desires to participate in this particular activity. In the National Buildings Record, there is a collection of about a quarter of a million photographs, and, according to Mr. John Summerson, a high proportion of these illustrate cast-iron designs. He tells us that " There is a good deal still to learn about the history of cast iron, and the knowledge may well prove as valuable to the craftsman and designer as to the historian himself." It can be presumed that by so doing, one would learn the reasons for the rises and declines that have taken place in the popularity of cast iron as a building material.

One architect, Mr. M. Hartland Thomas, tenders the following advice, " if the ironfounders want to shock the market into rapt attention, let them restyle their material for the modern age." Yet the general impression gained from a study of all the articles is that the founder has been badly let down by the architect. It is stressed that the Victorian architect not only used cast iron for atrociously unartistic decoration, but made matters worse by employing it as *ersatz* wood, stone and brick. Surely the Victorian foundry owner was not to be blamed for assuming that the buyer is always right—especially if that buyer be a professional man and the salesman only a tradesman. It seems to us that as foundrymen, our primary duty is to place at the disposal of the architect and the designer in general a plain unvarnished statement of properties and potentialities of castings. Mr. John Gloag pertently points out that " The last work that dealt at all thoroughly with the subject was 'The Application of Cast and Wrought Iron to Building Purposes,' by William Fairbairn, C.E., which reached its third edition in 1864." With this statement we would be inclined to agree, if the qualification were added " British," as the Americans have in recent years made worth-while contributions to the subject.

This placing of factual matter before designers we have designated as " primary," but that is not sufficient, as such efforts must be supplemented by others designed to interest the general public. An example of this is the excellent exhibition now open to the public at Selfridges' Oxford Street store. Organised by the Aluminium Development Association, it has as its object the interesting of the public in the peacetime products of this important industry. After the opening ceremony, a statement was made by a leading personality in the light alloy industry that after experiencing the close cordial collaboration with Selfridges, it was felt that they, and probably all the metallurgical industrialists were but tyros in the art of salesmanship as compared with the great retail sales houses. It is this sales " Know-how " that has to reinforce the dissemination of facts in the form of a well-illustrated text book which is the essential for continuous success.

Contents

Castings in Architecture, 109.—Meehanite Research Institute, 110.—Inclusions in Lead-Bearing Steels, 110.—Aluminium Exhibition, 110.—Consistency and the Cupola, 111.—Correspondence, 117.—Thermal Lag in Heat-Treatment, 118.—Plaster, Plastics and Low Melting Point Metals in Patternmaking, 119.—Stewarts and Lloyds, 124.—New Trade Marks, 124.—Publication Received, 124.—Colvilles, Limited, 126.—Control of Labour, 126.—Company Results, 128.—British Steel Producers' Conference, 128.—News in Brief, 128.—Contract Open, 128.—Raw Material Markets, 130.—Personal, 130.

MEEHANITE RESEARCH INSTITUTE

The annual meeting of the Meehanite Research Institute, which was held in London on Thursday and Friday of last week, concluded with a dinner at Grosvenor House, Park Lane, W. The function was presided over by Mr. N. E. Rambush, a director of the International Meehanite Metal Company, Limited, and Ashmore, Benson, Pease & Company, Limited. After honouring the loyal toast, Mr. P. L. Gould (Gould's Foundries, Limited) proposed the prosperity of the International Meehanite Company. He deplored the absence of two of its directors, Mr. Oliver Smalley, O.B.E., who had been unable to cross the Atlantic, and Mr. John Cameron, who was convalescing after a serious illness. Mr. Rambush announced a change in the chairmanship of the Research Institute, and made a strong appeal for a better balance in the contributions by the licensees to the research programme. Some members were doing virtually nothing whilst others were sponsoring very extensive programmes.

Mr. R. B. Templeton (Ealing Park Foundry, Limited), proposed "The Guests," and made a plea for better publicity from the foundry industry as a whole. It was obvious that other interests were conscious of the value of wide-scale publicity. The first reply was made by Mr. J. W. Gardom, president of the Institute of British Foundrymen. He, too, was concerned with the lack of a general publicity for the industry and counselled the Meehanite interests always to bear this in mind in all their activities. On his part, he was taking steps to ensure a better recognition of the fundamental position the foundry industry occupied in relation to other industries and professions. Mr. A. E. Chell, M.I.Mech.E. (Rodney Foundry Company), who but the day previously had resigned from his position as Joint Director of Iron Castings at the Iron and Steel Control, said that by their ability in many cases to replace steel, the Meehanite licensees had made a major contribution to winning the war in Europe.

Experience in the Dominions

Mr. V. C. Faulkner, Editor of THE FOUNDRY TRADE JOURNAL, reviewed some of the more outstanding developments during the war which had taken place in the industry; dealt with some essentials for its future conduct; and concluded with a review as to how Meehanite was being regarded by the rest of the industry. In this connection he stressed how in the Dominions licensees had supplied castings of a type which had hitherto been imported and had in most cases reported superior life over the components they had replaced.

Finally, Mr. W. H. Richards (Richards (Leicester), Limited) proposed "The Staff," to which Mr. E. W. Harding and Mr. E. M. Currie (managing director) replied.

ACCORDING TO LEONARD WESTRATE, writing in "Automotive and Aviation Industries," the composition of Ford's tri-alloy bearing metal is 35 to 40 per cent. lead, 4.5 to 5.0 per cent. silver, the balance being copper with a trace of iron.

INCLUSIONS IN LEAD-BEARING STEELS

Microscopical examination of samples of lead-bearing steels and ingot irons has revealed small characteristic inclusions which are not present in similar lead-free materials. An investigation in this connection is the subject of a Paper entitled "The Microscopical Examination of Samples of Lead-Bearing and Lead-Free Steels and Ingot Irons," submitted by T. H. SCHOFIELD, M.Sc., to the Iron and Steel Institute.

Summarising his conclusions, the author says that all the lead-bearing materials show inclusions which have a rough and mottled appearance after using a normal polishing technique for steels; these inclusions appear white and smooth after using a modified polishing technique. Inclusions of this type are not observed in the lead-free materials. When polished in the normal way the inclusions resemble certain inclusions in lead-bearing brass.

The rough and mottled appearance of the inclusions after normal polishing indicates that they have been partly removed, *i.e.*, they are relatively soft or brittle. An etching test shows that inclusions consist of or contain lead, and are removed by mercury at 100 deg. C., which suggests that they consist of a metal or metallic compound that alloys with mercury. Heating experiments do not provide definite evidence that the inclusions had melted at a temperature just above the melting point of lead.

ALUMINIUM EXHIBITION

An exhibition designed to show the transition of light alloy manufactures from war to peace was opened at Selfridges, Limited, Oxford Street, London, on May 30, by Mr. Ernest Brown, Minister of Aircraft Production, in the presence of a distinguished company. The Mayor of St. Marylebone presided. In general, the exhibition, which is quite extensive in character, shows a number of prototype designs of a distinctly promising character.

Centrally placed is a speed-boat belonging to the late Mr. Percy Pritchard, which has been submerged in sea water for most of the war period, yet, after refurbishing, now looks brand new. A new set of murals, of particularly effective appearance, have been designed. Before this note is published, there will be on exhibition at the rear of the stores a completed, fully furnished aluminium house. Of this we hope to report in a future issue.

It was stated at the opening ceremony that this industry now employs a million people, so that the problem of maintaining its wartime activity is indeed a problem demanding the utmost courage and enterprise by those bearing the heavy responsibility for its future welfare. The Aluminium Development Association has been responsible for the organisation of this initial effort.

IN THE FIRST YEAR of its application as a base for carbide-tipped tools in America, over 700 tons of Meehanite was used.

CONSISTENCY AND THE CUPOLA*

An outline of factors affecting the control of cupola melting

By C. A. PAYNE

The developments in the metallurgy of cast iron during the last decade have established a new reputation for cast iron as an engineering material, with its own distinctive properties and advantages. To ensure successful maintenance of this reputation the pre-eminent requirement is a consistency of both composition and properties, on a par with that obtained in competitive materials produced in batch melting units. The cupola has been for many years, and for many years to come will be, the furnace employed in the manufacture of cast iron. Much of the necessary control required is the carrying out and the following up of the obvious, particularly those items which are so very obvious as to be most frequently overlooked.

The two most important attributes of the cupola are its adaptability to varying loading conditions, and its flexibility of operation. It is essential, however, to avail oneself of these advantages; to aim at uniformity and consistency of operation. There is a world of difference between the flexibility that permits planning of metal distribution before the blower is on, and that which leaves one wondering just what has been tapped out and into which mould it can safely be poured.

The firmer the belief that "every cupola is a law unto itself," the g ater the admission of our unawareness of the many details governing cupola operation. The more positive the knowledge of these details, the more definite will become the control of melting, and the more certain the establishment of general laws for the operation of all cupolas. These laws are based upon the physical and chemical principles of combustion and reaction between air, fuel, and metal in both solid and liquid states. The ideal reactions of the laboratory cannot be achieved in practice. Standardised conditions, however, can, and must be achieved for successful control. Variations in raw materials and in melting conditions are the only causes of variations in the final product. The raw materials must be verified by analysis and testing, the melting conditions standardised, and then maintained by competent control and supervision.

Cupola Design

Obviously, cupola control begins long before the blower is put on, not only with respect to the raw materials, but with regard to the cupola itself. The field of cupola control is extensive and the details manifold. The majority of foundries are in possession of plants the design of which must in the main stand without alteration. The least that can be done, however, is to know, with accuracy, the true dimensions of the cupolas operated, and to have a reliable drawing—not that supplied by the constructors, but one made from the cupola as it actually is. Certain dimensions can be regarded as constants; others are those which may, if control be not exercised, vary markedly and erratically.

The value of such a record depends solely upon its being utilised to check the frequently imperceptible daily drift from one set of standardised conditions to something entirely different and undesirable. Correlating the data for differing diameter cupolas, which can only be done by expressing dimensions in terms of the controlling factor, diameter or area at the melting zone, is the first step towards ironing out the differences between various cupolas. As a digression, the fullest benefit will not be attained until it is possible

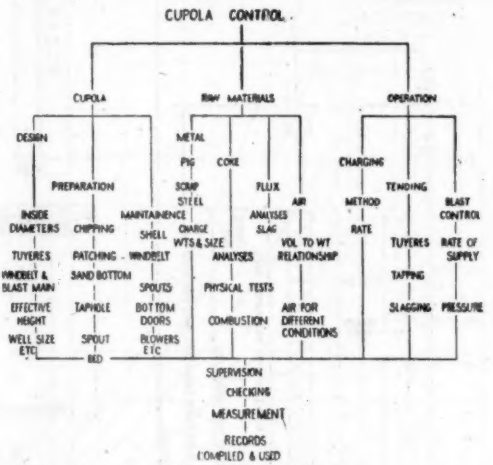


FIG. 1.—CUPOLA CONTROL.

to collect, compare and correlate data not merely from a number of cupolas on one plant, but information from a number of plants.

Practical Pointers

What do all these dimensions mean, and how do they affect operation? Some practical pointers can be given in this direction. First and foremost is the diameter of the cupola at the melting zone. The amount of coke that can be burnt in a given time is controlled by the area of the cupola at which it is burning. The weight of metal that can be melted is governed by this weight of coke, making allowance for the completeness or otherwise of combustion, the type of raw materials to be melted, and the temperature desired at the spout. These penultimate and last

* A Paper presented to the East Midlands Branch of the Institute of British Foundrymen, Mr. F. G. Butters presiding.

Consistency and the Cupola

items are, or should be, known; the composition of the waste gases can be checked, albeit with a certain amount of difficulty, to give a guide as to combustion conditions. These three factors being known, then it can truly be said that the melting rate of the cupola is proportional to the diameter (or the area) of the melting zone. With what, for lack of more detailed information, is called "average melting practice," the melting rate may lie within the range 8 to 12 lbs. per sq. in. of area per hr.

The height of the stack, from the sand bottom to the charging sill, is settled by two considerations, sufficient height to prevent undue heat losses from the escaping gases, but limited by the load that the coke will sustain. The height of the tuyeres above the bottom, in the case of cupolas operated without receiver and a front slagging spout, must be sufficient to allow of the slag hole being opened with a minimum of one complete tap in the well. The well capacity (*i.e.*, from sand bed to slag hole level) should be based on a consideration of metal charge weight; if more than one charge is required to be tapped out at one time, then the well capacity should be a simple multiple of the charge weight, and not in fractional multiples. This is admittedly based on an estimated 40 per cent. of the total volume of the well, being taken as the percentage of voids in the coke filling. Thus the well is a receiver filled with more or less incandescent coke, and a mixture of iron and slag. There should be sufficient space and time for collection of molten constituents, and for the separation of the slag from the metal. As these molten constituents are collected in the interstices of the coke filling, diffusion of the various constituents within the well to form a homogeneous liquid is unlikely, and such a mixing most probably does not occur until the iron is tapped out into a suitable ladle or separate receiver.

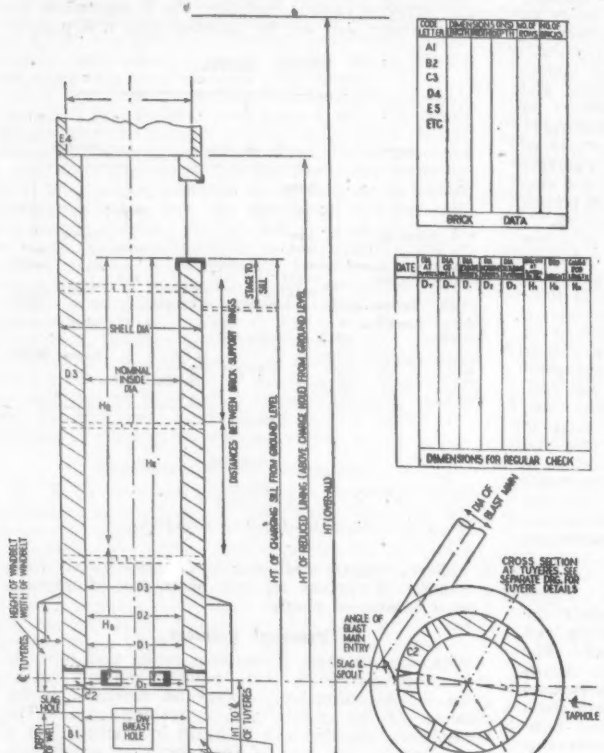


FIG. 2.—CUPOLA LAYOUT.

Thus the advantages of a separate receiver are obvious, the main one being the intimate mixing of several charges, without the influence of coke in various stages of combustion and slag contamination. It must be emphasised, however, that the receiver is not a cure-all for bad melting practice. Indeed, if cold melting ensues, then the receiver will aggravate the trouble; nor is it of advantage when melting more than one type of mix in the same run, as it will add to the already knotty problem of charge dilution.

Tuyere Arrangement

Tuyeres, their number, shape and disposition have been a fruitful source of discussion for many years. This question is settled with reasonable satisfaction on the following basis. The main function of the tuyere is to convey the blast from the windbelt, and to distribute it as evenly as possible over the cross-section of the cupola. The total number and area of the tuyeres are best related to the cross-sectional area at the melting zone, the total tuyere area being one-quarter to one-tenth (a wide enough range) of the cross-sectional area, the smaller diameter furnaces having the larger ratio of tuyere area. The number of tuyeres is best kept at a minimum consistent with fairly uniform blast penetration. A simple rectangular shape, with an increase in width at the working face of the lining, and a slight downward slope of the bottom

(to discourage the entry of metal and slag) is the preferred shape.

Increasing both flare and the number of tuyeres to present a continuous opening round the inside of the cupola has been one way of attempting to secure uniform air flow. Certainly in this case, lack of uniform blast penetration cannot be blamed upon the inadequacy of tuyere openings. Before leaving the subject of tuyeres, one very useful point is to have one of them set a good ¼ in. to 1 in. lower than the others. One preferably by the tapping spout, so that the cupola tender has no excuse for not seeing it. This merely serves as a gauge of the slag and metal in the well, the first signs of such coming up to the level of this lower tuyere being the signal for immediate action on the part of the tender.

The uniformity of blast distribution is as much a function of blast main as of windbelt design. The volume of the windbelt should be sufficient to enable an approach to uniform air flow and pressures at all points to be achieved, without having it so big that there is an excessive drop in pressure, and an appreciable time required for the blower to fill it with air at the working pressure. The diameter and direction changes of the blast main also enter into the problem of establishing control. Bends and turns, changes of diameter, and the occurrence of branches or divisions of the main all affect the steady flow of air, oft-times rendering reliable measurements of volume impossible, and equally often demanding extra input of energy into the blowing unit in order to overcome losses due to friction and turbulence. It is rarely that alterations can be made to the blast main in an established plant, but at least the influence of its layout can be appreciated.

Lining Contour

The advantages of boshing or constrictions in the lining above the tuyeres do not outweigh the disadvantages, except for very special purposes. Very rarely is the bosh contour retained accurately in repatching between heats, and if the bosh be above the melting zone, it is always a potential source of hanging and scaffolding of charges in their descent down the stack. If the bosh be set at or just below the level of the melting zone, a ridiculous but not impossible condition, no diminution of burn-out and cut-back is evidenced, and patching usually results in a funnel-shaped lining.

A parallel lining from charging sill to tuyeres is the ideal, with the tuyeres set back about ½ in. behind this lining. To obtain increased well capacity, with a given height, a good set-back below the tuyeres is made. Whatever the shape, good results from a brick lining will not be obtained unless the greatest care is taken to ensure the best possible jointing. Beautifully pointed brickwork, whatever its architectural value, is a certain step towards rapid lining wear. In how many cases does the location or planning of a cupola installation demand the impossible from the cupola tender? Such factors as the need for major demolitions of walls and girder work to give accessibility to all parts of the cupola, the requirement of superhuman insensitiveness to heat in order to attend to certain of the tuyeres, after tapping or slagging has once started; these are frequently more potent factors in cupola control than the best laid plans of managers and metallurgists.

Maintenance of the Cupola

Such factors, too, are not to be dissociated from the maintenance of the cupola, a maintenance generally conspicuous by its application after the occurrence, which intelligent maintenance should prevent. Air leakages round tuyeres and sight-hole covers, absence

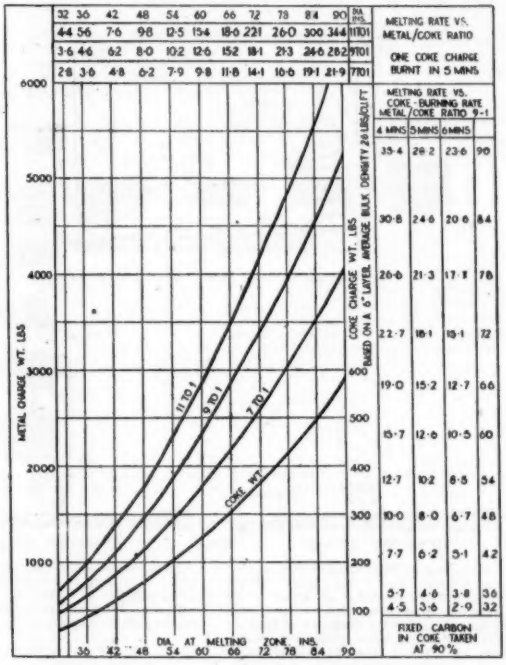

DIA. INS.
MELTING RATE VS. METAL/COKE RATIO
ONE COKE CHARGE BURNT IN 5 MINS
MELTING RATE VS. COKE - BURNING RATE METAL/COKE RATIO 9-1
4 MINS 5 MINS 6 MINS
METAL CHARGE WT. LBS
COKE CHARGE WT. LBS BASED ON A 6" LAYER, AVERAGE BULK DENSITY 28 LBS/CU FT
11 TO 1
9 TO 1
7 TO 1
COKE WT.
DIA. AT MELTING ZONE INS.
FIXED CARBON IN COKE TAKEN AT 90%

FIG. 3.—MELTING RATE VARIES WITH DIAMETER; COKE RATIO AND BURNING RATE.

of mica windows, or windows through which one cannot see anything clearly, blast gates or valves which cannot be opened fully or shut off completely without hammering or damaging of levers; windbelts well lined with cold iron, slag and coke breeze, bottom doors which rock on their hinges or wedge tightly against one another when closed, tapping and slagging spouts bent and burnt, spouts which dare not be touched because they have "just been fixed up." These items all detract from the efficiency of the furnace operation, if only due to their psychological influence.

Attention to these matters will encourage a more

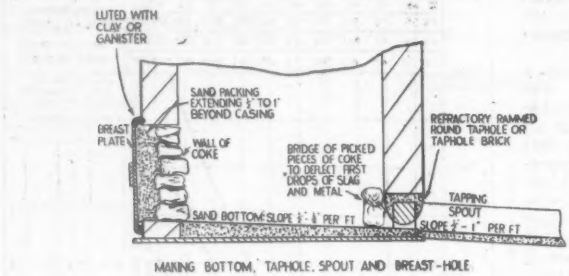
Consistency and the Cupola

correct attitude on the part of the workman to the preparation of the cupola before the heat commences. This generally starts with chipping down after the previous run, its object being to prepare a sure foundation for the layer of patching material. All slag and cold metal accretions have to be removed, but not the glazed surface of the unattacked lining; this merely requires nicking at irregular intervals to afford better keying of the daubing. It is around the tuyeres that the greatest care is needed. After chipping and patching the dimensions of the tuyeres must be restored through the thickness of the patching, and precautions must be taken to ensure that the contour of the lining, above the tuyeres, does not allow metal and slag to drip down into the tuyere, to be chilled and so form obstructions to the blast.

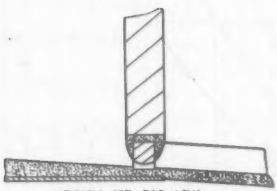
The patching material used is invariably applied wet —more often than not, too wet. Just sufficient moisture to give plasticity and adhesion is required, although these properties are as much a function of the nature and particle size of the particular refractory material used. The desired grading is not one of a single particular size, for such factors as the workability, self-venting for rapid drying, shrinkage on drying, and the withstanding of service conditions, must be considered. This question of moisture is not to be overlooked, for satisfactory cupola operation as well as efficient use of patching material. The less water in the lining, the quicker and more effective the drying. With higher moisture content, there is a greater tendency to shrinkage-cracking on drying and more danger of steam pockets below the lining surface to cause spalling or collapse of the lining.

Drier refractory is more difficult to apply, but the patcher can relieve his feelings by that little extra vigour which will ensure adequate ramming and cohesion. Smoothing over with a trowel is good and desirable, but sleeking with a bucket and a 3-in. brush is as much use as it would be in finishing off a sand mould before closing. The final step when the bore of the cupola is restored to its standard diameter is to vent thoroughly with a stout wire. It must not be forgotten that the primary object of patching is to restore the internal dimensions to the standards upon which the performance of the cupola has been based, and this can be checked only by measuring.

In the case of the now almost universal drop-bottom cupola, the next step is putting in the sand bottom, a job which is of the same order as preparing a mould. Uniform density of ramming, a good tucking round the edges of the well, a uniform gentle slope from all directions towards the taphole, are required. The sand used should be sufficiently refractory to withstand the temperature of the metal. A thin, fritted top layer should result, but if the sand is insufficiently refractory, a fused, slagged mass remains at the end of the run, a trial to the temper, and a threat to the safety of the men responsible for dropping the bottom. Hard ramming or high moisture will cause a boil of the metal lying on the sand, with consequent disturbance of the bottom, usually followed by extraneous and unofficial tapholes in unexpected and inaccessible locations.

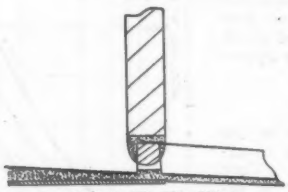

LUTED WITH CLAY OR GANISTER
SAND PACKING EXTENDING ½" TO 1" BEYOND CASING
BREAST PLATE
WALL OF COKE
BRIDGE OF PICKED PIECES OF COKE TO DEFLECT FIRST DROPS OF SLAG AND METAL
REFRACTORY RAMMED ROUND TAPHOLE OR TAPHOLE BRICK
TAPPING SPOUT
SAND BOTTOM-SLOPE ½" - 1" PER FT
SLOPE ½" - 1" PER FT

MAKING BOTTOM, TAPHOLE, SPOUT AND BREAST-HOLE



TAPHOLE SET TOO LOW

Metal cannot be drained from taphole: may set and cause "hard hole" stream striking the raised lip of spout to be deflected upwards and may go over side of spout. Effective diameter of taphole will be reduced with consequent reduction of rate of flow with continuous tapping. This may lead to a well too full and a temperature too low.



TAPHOLE SET TOO HIGH

Metal cannot be fully drained from well; will tend to cause lower tapping temperatures at start of run. Metal will tend to issue as a jet giving an uncontrollable stream.

FIG. 4.—THE LAST STAGES OF PREPARATION.

Taphole Practice

The taphole, whether rammed up in place or formed by previously prepared refractory blocks in a corebox, or as a special brick, must be positively located with respect to the sand bottom, and the spout bottom in turn located from the taphole. The slope of the spout must be uniform and consistent, be it a straight spout or of the special designs put forward for more effective spout treatment of molten iron. In any case, a wooden former will repay amply for its preparation by the facility with which desired results

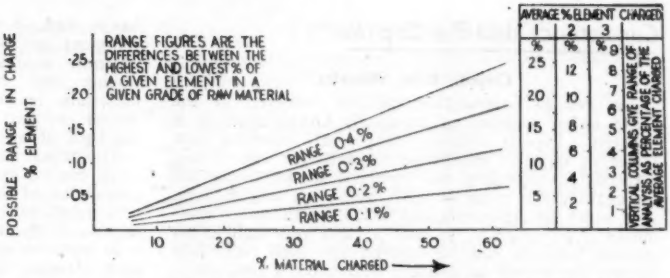
can be reproduced. Any patching and surface dressing (blacking or plumbago) must be most thoroughly dried before tapping commences.

Drying Out

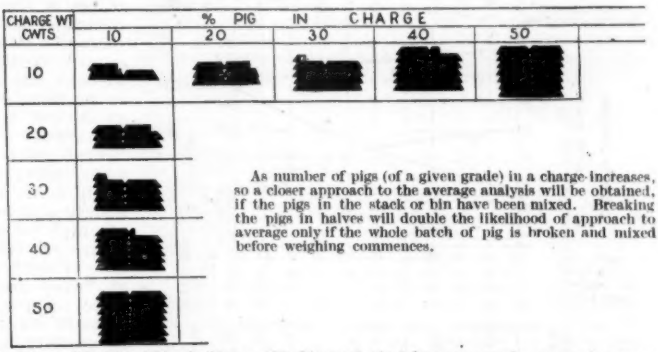
When lighting the fire, the aim is to get uniform combustion over the area of the well. The convenience of oil or gas torches, too, often results in an intense heat at the nozzle of the torch, and black coke everywhere else. If the patching has not had time to dry out before the fire has got under way, then common sense dictates that the fire be utilised to finish the drying, before the patching is pulled off the walls by the coke tipped in to make up the bed.

The objects of the bed in the cupola are to support the burden, to preheat the lining and to provide the initial coke charge for melting. Making up the bed properly requires somewhat more coke than fills the space between the first charge and the sand bottom at the commencement of blowing. The longer period that elapses between the completion of the bed and the commencement of melting, the greater will be this difference. To ensure adequate preheating of the lining during the making of the bed the coke should be added in portions, time being allowed between the additions for the previous coke to burn through evenly (not burn away thoroughly).

Where charging up takes a long time, and if the charged cupola has to stand a while before the blower is put on, then charging should be started while the last portion of the bed coke is still black. Charging on to a bed burnt right through to a bright red permits of no delay before the blower is put on. Whatever method be adopted, the procedure must be standardised and adhered to for consistent results. The height of the bed is another of the standard dimensions that must be regularly checked, by means of gauge-rod or weight and chain.



I.—*Variations in Charged Analysis* versus *Range of Analysis of Raw Materials Charged.* Range of Charged Analysis increases with :—
(*a*) Increasing Range in Raw Materials.
(*b*) Increasing Percentage of Material Charged.
(*c*) Decreasing Average Per Cent. Element Charged.



As number of pigs (of a given grade) in a charge increases, so a closer approach to the average analysis will be obtained, if the pigs in the stack or bin have been mixed. Breaking the pigs in halves will double the likelihood of approach to average only if the whole batch of pig is broken and mixed before weighing commences.

II.—*Size and Weight of Pigs in Charge.*—Machine-cast pig taken as example, assumed average weight (unbroken), 80 lb. (approx.). Actual weight may vary from 60 to 120 lb. depending on thickness.

	Actual Analyses.			Charge.		Analysis Charged.					
	T.C., Per Cent.	Si, Per Cent.	Mn, Per Cent.	Pig.	Per Cent.	T.C.		Si.		Mn.	
						High.	Low.	High.	Low.	High.	Low.
Range...	3·9/4·2	1·6/1·9	0·6/0·9	A	25	1·038	0·975	0·475	0·40	0·225	0·150
Mean ...	4·0	1·75	0·75								
Range...	3·8/4·1	2·0/2·4	0·6/0·8	B	15	0·615	0·570	0·360	0·30	0·120	0·090
Mean ...	3·9	2·2	0·70								
Range...	3·2/3·4	2·5/2·75	0·8/1·0	C	15	0·510	0·480	0·413	0·375	0·150	0·120
Mean ...	3·3	2·6	0·9								
						2·163	2·025	1·248	1·075	0·495	0·360
Possible range of charged analysis, per cent.						0·138		0·173		0·135	
Charged analysis calculated on mean						2·08		1·124		0·428	
Variation possible as per cent. of mean analysis ...						6·6		15·4		31·5	

III.—*Example of Calculation Showing Cumulative Effect of Pig-iron Variations.*—On charged analysis. The variations shown above will be affected by the factors (I) and (II) and by the degree of control over the returns (segregation or proper mixing), particularly with such influences as varying phosphorus or where Fe-Si, or similar alloy ladle additions are made.

FIG. 5.—VARIATION IN RAW MATERIALS AND CHARGE ANALYSIS.

Consistency and the Cup Ia

Cupola Raw Material

No desired composition can be achieved at the spout unless material of accurately known analysis is charged. Typical analysis ranges of incoming raw materials serve to emphasise the need for one of two methods for handling raw material stocks, either the segregation and using of each individual wagon load, with small consignments and usage, or thorough mixing of a given grade, so that a close approach to an average analysis can be assured for each individual charge, not merely an average over a day's run.

The stacking of pig-iron (not so easy a matter with some of the machine-cast pig shapes) is always to be preferred to just throwing up untidy and uncontrollable heaps, and, if within the stack, each wagon or consignment can be identified then in the event of non-uniform analysis, a most valuable opportunity of tracing and remedying the fault, if due to raw materials, is always at hand. The extra time and labour required to do this job are to be regarded in the light of an insurance.

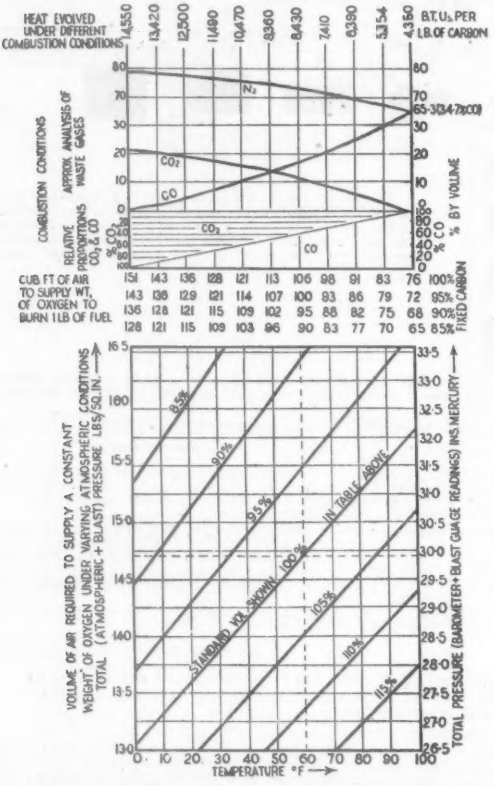

HEAT EVOLVED UNDER DIFFERENT COMBUSTION CONDITIONS
14550 13420 12500 11490 10470 9360 8430 7410 6390 5354 4350 B.T.U.s PER LB. OF CARBON
COMBUSTION CONDITIONS
APPROX. ANALYSIS OF WASTE GASES
RELATIVE PROPORTIONS CO2 & CO
% BY VOLUME
CUB. FT OF AIR TO SUPPLY WT. OF OXYGEN TO BURN 1 LB OF FUEL
151 143 136 128 121 113 106 98 91 83 76 100% FIXED CARBON
143 136 129 121 114 107 100 93 86 79 72 95%
136 128 121 115 109 102 95 88 82 75 68 90%
128 121 115 109 103 96 90 83 77 70 65 85%
VOLUME OF AIR REQUIRED TO SUPPLY A CONSTANT WEIGHT OF OXYGEN UNDER VARYING ATMOSPHERIC CONDITIONS TOTAL (ATMOSPHERIC + BLAST) PRESSURE LBS/SQ.IN.
TOTAL PRESSURE (BAROMETER + BLAST GUAGE READINGS) INS MERCURY
85%
90%
95%
IN TABLE ABOVE
100%
STANDARD VOL. SHOWN
105%
110%
115%
TEMPERATURE °F

FIG. 6.—VOLUME OF AIR PER LB. OF FUEL VARIES WITH ATMOSPHERIC CONDITIONS AND COMPLETENESS OF COMBUSTION REACTIONS.

The actual range of analysis permissible in a given stack can be fixed by a consideration not only of the proportion of the charge formed by the particular pig concerned, but by the weight and size of the pigs relative to the weight and size of the charge.

In addition to being certain of the percentages of each element being charged, the changes in analysis during melting should also be known. The object of knowing the analysis charged is to obtain desired composition of the tapped metal. Comparison of calculated, charged composition with the analyses actually obtained is the only way of finding out the actual values of the gains or losses. Carbon and silicon are the major controllers of structure and properties, and these two elements are particularly sensitive to changes in melting conditions. Quite apart from the influence of coke size and properties, and of blast control, yet to be discussed, the form, size and surface condition of the raw materials must always be taken into consideration.

Uniformity of size and shape of charge materials would make for simplicity in charging practice, but rarely is it possible to achieve this. Regularity of materials from one charge to another should be obtained. This means little more than avoiding one charge of light, small material followed by another one, of supposedly similar materials, but composed of all heavy pieces. The gain from breaking oversize pieces of pig or cast iron is so obvious from the point of view of both handling and uniform melting. By oversize is meant any piece the greatest dimensions of which is one-third or more of the cupola diameter. With flat plates this dimension needs to be even further reduced. Especially is this so when steel is charged, so as to avoid scaffolds and chambering, with consequent irregular charge descent, sometimes accompanied by severe melting losses.

Whilst very small-sized pieces, particularly steel turnings or punchings, can be and have been melted with apparent success, they cannot be handled in the same charges as heavy steel rails, machine-cast pig and ingot-mould scrap. Rusty, or excessively sandy surfaces require increased flux for efficient slagging, increased coke to fuse the slag, and an increased melting loss, particularly with rusty steel.

The type of charge and of material to be used should be governed by the requirements of the finished casting, although wartime conditions have made it more a function of material supplies than anything else. The range is a very wide one, from highly phosphoric pig and light scrap charges, to high-steel, low-carbon and low-silicon mixes, with or without alloy additions to the burden. The proportions of the various constituents are fixed by the chemical composition, the analysis of the raw materials and the physical properties required. The

physical properties cover not only the mechanical test results, but those characteristics of molten metal called for want of a more definite term, "foundry properties."

Coke Control

This is the more tangible component of the heat supply, but not necessarily the most controllable item in melting practice. In the simplest terms it is impure carbon, the impurities being the residue after burning, which have to be removed by making it into slag, and the portion which escapes in gaseous form when the coke is heated. The net usable content of carbon, the "fixed" carbon, may vary considerably from the classical 90 per cent. so often quoted and used for calculations in the published literature. Wartime experience of coke supplies emphasises the fact that consistency in properties, rather than a high fixed carbon, *per se*, is the most desirable feature to be sought. Unfortunately, in the present state of knowledge of the fundamental properties of coke as a fuel, the only complete and reliable guide to this consistency is to melt iron with it in the cupola.

Be that as it may, there is no reason for not carrying out some tests on the incoming supply for useful data. The fixed carbon content (the fuel part of the material) cannot be found without finding the ash and volatile matter, and the ash is a guide to slag formation. A porous material, lacking only the compressibility of the bath sponge, the coke will need to be checked for moisture content, affecting, as the moisture does, not merely the "bulk density" of the material, but the combustion reactions as well.

Size, strength and toughness are other aspects to be considered. Size (though not size alone) affects melting, and compositional changes in melting. Size is influenced by the ability, or otherwise, of the fuel to withstand the physical loads and the shocks to which it is likely to be subjected in charging.

Taking a rational view of cupola melting, a supply of fuel (*i.e.*, coke) is burnt, and part of the heat therefrom utilised to melt, to alter the composition of and to superheat the iron. The rate at which the fuel is burnt depends upon the area over which combustion takes place. With a given diameter of cupola, the volume of coke burnt, in unit time, with a required thermal efficiency, is fixed within certain narrow limits. For optimum conditions a 6-in. to 8-in. layer of coke forms the ideal charge. With a reliable grade of coke, this gives the weight of coke split, and the weight of the metal charge is then to be assessed on the basis of this figure.

This brings us to the all-important question, how is one to measure the coke, by weight or by volume? As the metal charge is weighed, then a known weight of carbon is required for its melting. Weighing, if the fixed carbon and moisture content of the coke be known, enables this weight of carbon to be accurately obtained. Variations in coke grading, and in bulk density, however, will vary the weight of coke in the ideal charge layer. Measurement by volume will give this desired layer, and is not affected by the moisture

(*Continued at foot of next column.*)

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.

THERMAL LAG

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—It was my pleasure and privilege to hear Mr. Peace expound his theories on this subject, and even apart from the brilliant discussion created, I am still in doubt as to whether he was pulling our legs.

Surely heat follows fixed laws, and because these malleable people overload the stoves or try to get the work through in the minimum time, surely it is not due to any faults of the heat element, and "You cannot get out what you don't put in," and I should not be at all surprised to hear that Vulcan had taken vengence on them. It appears parallel with the case of the woman who said her husband broke the window because he ducked.

Mr. Peace can, however, lay the flattering unction to his soul that he created a wonderful discussion and left impressions even such as this, but, of course, we must remember that it is still the month of March.

Yours, etc.,

G. W. BROWN.

162, Wheelers Lane,
King's Heath,
Birmingham, 14.
March, 1945.

[Note.—The discussion on Mr. Peace's Paper is printed elsewhere in this issue.—EDITOR.]

AN INSTRUMENT—the vibrograph—marketed by Westinghouse Electric Company, of East Pittsburg, Pa., makes a permanent record of vibrations from 600 to 15,000 cycles per minute. Needing no power connections and weighing but 9 lb., it operates in a manner similar to a seismograph.

THE "NICKEL BULLETIN" for April contains abstracts dealing with powder metallurgy, fretting-corrosion, the influence of water vapour on nickel catalysts, concentration of caustic soda, plating without current and recent modifications of N.E. steels. Copies may be obtained, free of charge, from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

(*Continued from previous column.*)

content, but it does not give any indication of the actual weight of carbon, affected as this will be by the variations in fixed carbon, and density. Whichever method be used, correction and adjustment in coke charge size must be made either to the amount of coke, to give a constant weight of carbon, or to the weight of metal, according to the known weight of carbon charged. In other words, one of the factors to be determined with either method is the weight of fixed carbon per cubic foot of coke.

(*To be continued.*)

THERMAL LAG IN HEAT-TREATMENT OPERATIONS WITH PARTICULAR REFERENCE TO THE ANNEALING OF MALLEABLE CAST IRON

By A. E. PEACE

Discussion on a Paper read before the Birmingham branch of the Institute of British Foundrymen, Mr. G. R. Shotton presiding. The Paper was printed in our issue of May 24.

A cordial vote of thanks having been passed to Mr. Peace, on the proposition of Mr. T. R. Twigger, seconded by Mr. J. H. Geeves, the CHAIRMAN (Mr. G. R. Shotton) referred to the example quoted by Mr. Peace of an axle case 14 in. in diameter, which he mentioned was annealed in a 22-in. pan. The chairman wanted to know whether the casting was placed centrally in the pan, or if one edge of the flange was adjacent to the wall of the pan, Secondly, what temperature lag would Mr. Peace assume to have operated to cause such a big difference? He would also be glad, he said, if the lecturer would discuss a little more fully the subject of forced draught convection and natural convection.

In reply, MR. PEACE illustrated the position of the casting in the pot, and said it was also possible there was restricted convection of oven gases down the pot. The furnaces were top fired, and the heat at the bottom essentially got there by convection although there would be some heat conduction downwards through the pot. As to the temperature lag, the amount of carbide left required very little time at a temperature of 850 to 900 deg. C. to be completely decomposed. In practice their ideas of annealing times for both blackheart and whiteheart malleable were determined chiefly by experience, and unfortunately their experience did not take enough account of thermal lag. They got a wrong idea about the length of time necessary, and the temperature necessary, for complete annealing. This material contained round about 1 per cent. silicon, and such a composition annealed very readily. A period of time of the order of 30 hrs. at 850 or 870 deg. C. would be adequate to break down the carbides completely. Mr. Shotton appeared to think that in the circumstances of the case there would not be much natural convection. In point of fact there was a lot of natural convection, and they depended on it very largely for heating the charge. The pressure was only slightly above atmospheric.

Effect of Grain Size

MR. E. HOLLAND also referred to the axle case, and asked whether thermal lag had any relation to the running of the job. Was it definitely established that the runner was anywhere near the over-annealed or the under-annealed part? As to the continuous furnace, he would like to know whether the castings that came out unannealed were analysed to see whether they were of a low silicon content or whether there was any difference in the material.

MR. PEACE, in reply, said the position of runners and feeders had an effect, because they determined to a considerable degree the size of the original grain in casting. When adjacent to a feeder they expected a somewhat larger grain size which would take longer to anneal than a small grain size. Regarding the sleeves, the composition was quite normal and identical with many other castings examined.

MR. H. G. HALL corroborated what had been said on the effect of grain size, and went on to deal with thermal lag and normal oven cycles. While it was widely assumed that 30 hrs. was perhaps sufficient to come up to temperature they allowed 50 to 70 hrs. to cover the possibility of thermal lag. There was then a long cooling period. It seemed obvious that the electric furnace, with an oven that could come up to heat in two hours and could be accurately controlled for the necessary period, would show a tremendous saving both in time and money, and would yield a better quality product. On this point, however, he thought that some caution should be exercised. Personally, he found that attempts to bring castings up to heat in two hours often gave a very widely dispersed nodule formation and in consequence a greatly increased annealing time. He could confirm many of Mr. Peace's figures.

Electric Furnace Annealing

MR. PEACE, discussing the electric furnace, agreed as to the advantages, but pointed out that they had to be paid for because in the case of a batch-type electric furnace it could not be of large size, as there were certain limitations consequent on the difficulty of getting heat through the charge. If they had a thick charge in an electric furnace there would be considerable lag. He could get excellent results with electric furnaces, with a much greater degree of reliability and uniformity, and he could get them in a much shorter time. Annealing with large ovens was about a seven-day cycle, in and out. With the electric furnace it was quite possible to operate a three-day cycle, even with a fairly good sized charge, but it certainly cost very much more. There was something in this matter of costs which was not properly appreciated by many people.

Where malleable annealing practice was economical, that was to say where it was efficient and well operated, the annealing costs were a very small proportion of the total costs. In his own case it cost them 50 per cent. more to fettle the casting than it did to anneal it. As to rate of heating *versus* nodule formation, when they first carried out experiments with electric annealing they immediately came up against the problem. They had a furnace which they could push on to 40 kw. They then found out how long it took to anneal at the holding temperature. They were surprised that it took so long. He thought that the time taken to reach a temperature of about 900 or 930 deg. C. in the electric furnace was something like four hours, and they had to expand that time to about 10 or 12 hrs. in order to reduce the time over-all. The effect of rate of heating on time of graphitisation was most important.

Brass Strip

MR. A. DUNLOP mentioned a case where tightly wound coils of brass strip were being annealed in a

(*Continued on page* 123, *col.* 2.)

PLASTER, PLASTICS AND LOW MELTING POINT METALS IN PATTERNMAKING*

Decorative work and the use of plaster in the foundry

By H. PLUCKNETT

In an earlier Paper† the Author dealt with the making of plaster patterns in a very elementary stage. However, for the benefit of those who are not conversant with this type of work it is proposed to review some of the main points concerning the elementary stages. Plaster is not a new material in the foundry, especially where decorative work, such as coats-of-arms, memorial plaques, and large figures are concerned. Fig. 1 shows a plaster pattern of the Bognor Regis Arms, cast in bronze in 1934, whilst Fig. 2 illustrates a decorative " drop " for cast iron.

The cheapest plaster in the long run is the best, and this has been found to be a grade known as " Italian Fine." The price is about double that of the coarse plaster, but the difference in the strength is such that at least double the quantity of coarse must be used to achieve the strength attained with the " Italian Fine." In other words, castings made in coarse plaster must be made very heavy, but with the better material an average thickness of $\frac{1}{8}$ in. reinforced with canvas, is all that is necessary. Coarse plaster has a technique of its own, and generally must be gauged fairly stiff and accelerated with alum, and the lack of this understanding has in many instances turned many people against the use of plaster patterns. If improperly mixed this plaster never sets hard, and remains in such a state that it disintegrates either when being rammed or when being removed from the sand. In the latter case bits of soft plaster remain stuck all over the face of the sand causing much trouble and additional cleaning. On the other hand, " Italian Fine " plaster sets hard and firm if mixed to the consistency of thick cream, and if given several coats of shellac or cellulose lacquer it will leave the sand clean and in perfect condition.

Mixture Used

The most suitable consistency for mixed plaster is obtained by adding 2 lbs. of plaster to 1 pint of water, and the best method of mixing is to sprinkle the plaster on the surface of the water allowing it to filter through the fingers to avoid any lumps entering the water. Continue quickly until the plaster appears in a little mound and the water is almost all taken up, then stir quickly keeping the spoon on the bottom of the bowl to prevent air being beaten in and causing bubbles. This mix gives a good set with little expansion. Extra water should not be added to the gauge; that is to say, it is bad practice to try to thin down the gauge when it begins to set as this results in a very weak plaster. Should the mix begin to stiffen up too quickly stir in one or two teaspoons of size water. On the other hand, if gauged too stiffly by adding more powder than the water will readily take, the plaster will set quickly with a tendency to warp, twist and expand during setting, while generating considerable heat. Stirring should not take more than 30 secs., but during that time all lumps, if any, should entirely vanish.

Scrim is a coarse canvas used for reinforcing plaster, and can be obtained from rope and twine merchants in a variety of meshes—the most suitable being $\frac{1}{4}$ in. and $\frac{1}{2}$ in. Both of these grades have their uses for reinforcing, as with the open mesh the plaster is easily worked in, but on the finer and stronger canvas a brush should always be used, otherwise air pockets between the surface skin and the canvas are sure to appear.

In patternmaking, plaster is handled in exactly the same way as for decorative architectural work; in fact, all the art of the old-time plaster craftsman is brought into use, including running and double running, turning and double turning, which is very similar to struck work and sweeps in loam moulding.

Besides knowing how to handle plaster a knowledge of foundry procedure is, of course, essential to enable the plaster worker to allow for loose pieces, cores and drawbacks correctly. The wood patternmaker, however, will find plaster can save hours of tedious work; for example, a broken connecting rod of flywheel is brought in for casting, and a new pattern must be obtained. What could be simpler than to make a plaster mould of the broken pieces (placed or fixed together temporarily), and then a plaster replica? The alteration in form and size required for shrinkage and machinery purposes can be carried out in clay or plasticine, and takes but very little time as compared with woodwork.

Where repairs and replacements of national importance are concerned, days and even weeks can be saved by this method. No matter how complicated the casting plaster will reproduce it as easily as it would a plain surface. Consider the work entailed in making a wood pattern such as is illustrated in Fig. 3, which is 5 ft. 6 in. long. This was an emergency job, as an 80-ton quick-action press (Fig. 4) had cracked its main casing just above one of the cranks. It was decided to reinforce the whole top of the press with a cast-iron

* A Paper read in Exeter at a meeting organised by the Bristol and West of England branch of the Institute of British Foundrymen.
† FOUNDRY TRADE JOURNAL, January 15, 1942.

Plaster, Plastics and L.M.P. Metals

cap 1½ in. thick with reinforcing ribs over the bearings. Four plaster patternmakers started at 8 a.m. one day, and laid a clay fence around the area required. Into this space the plaster was poured, canvas laid in to strengthen it, and then thickened up to 1½ in., inserting iron rods and wood battens for the foundry wood screws. When set the cast was removed from the press, the upper surface properly cleaned, and the ribs added. A cast was then made of the inner face to act as a cradle for transport, and if desired as an oddside. By 4 p.m. the following day the completed pattern, approximately 5 ft. 6 in. by 3 ft., was on its way to the foundry—a matter of 64 hrs.' work.

FIG. 1.—PLASTER PATTERN OF THE BOGNOR REGIS COAT-OF-ARMS CAST IN BRONZE.

When large patterns in plaster are mentioned, the question of weight naturally arises. Take, for an example, a 2-ft. cube. One would probably think it would weigh a cwt. or two, but there is no need to waste good material in such a manner; all that is required is five slabs of plaster ¾ in. thick, and reinforced with one or two layers of canvas. One piece is laid flat on the bench, while the other four are placed around and kept upright and square with angle plates. The joints are then covered inside with canvas dipped in plaster.

The Problem of Mitreing and Jointing

There is no mitreing and jointing as in woodwork; in fact, gaps of ½ in. wide are usually aimed for, as it is easier to fill in an open crevice than a small one, and what is more it is stronger. To do this filling, plaster is poured into the gap or channel, and simply levelled off with a scraper when almost set.

Patterns from 6 in. to 6 ft. square can be made by this hollow method, and the inside may be filled with sand when being rammed. Wire hooks or pieces of wood are inserted for withdrawing the patterns from the sand, and on a job 3 ft. or 4 ft. square, a 2 in. by 1 in. batten will be found very convenient. When

FIG. 2.—GRECIAN " DROP " FOR CAST IRON.

securely fixed by lengths of canvas dipped in plaster, these battens form good handles, and steel whips or wood screws can be inserted and the pattern hoisted out by the crane.

Making a Press Tool

The system for casting these light fibrous castings is very simple. Take, for example, the making of a press tool from a skin supplied by the tinsmiths. A wall of boards or metal is placed around the pattern, so forming the sides of the tool. The whole of the interior is then greased with tallow, thinned out with 40 to 50 per cent. paraffin, and plaster laid on to an approximate thickness of ¼ in. Another bowl of plaster is gauged, adding one or two tablespoons of size water. This second mix is splashed all over the first ¼ in., and the two mixings blended together with a

brush or a piece of canvas dipped in plaster. It is important that the second be applied before the first coat has properly set, otherwise the face may be left on the pattern. Squares of canvas cut to a convenient size are laid on, either dry, or they may be dipped into the bowl of plaster beforehand; whichever method is to be used a brush must be used to bond the surfaces all together. If required more plaster can be mixed to thicken up the edges and fix the battens, etc.

Avoiding Pattern Rapping

Plaster patterns will not stand the rapping to the same extent as wood, and to overcome this an entirely new method has been developed. By this system use is made of "slip" or "loose" pieces wherever straight or parallel sides are imperative, such as deep channels, etc. Plaster lends itself to this application admirably, as can be seen by the examples of double-running (Fig. 5) and double-turning (Fig. 6). Before going any further, it would be as well to clarify this principle. Fig. 7 is a good example. Owing to the

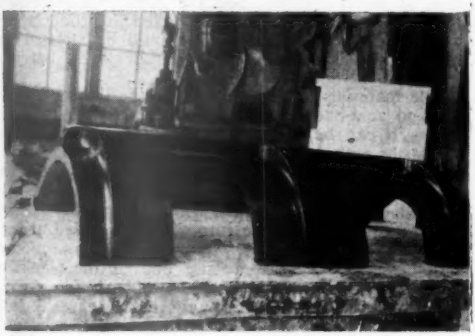


FIG. 3.—A QUICK ACTION PRESS REPAIR JOB FACILITATED BY THE USE OF A PLASTER PATTERN.

deep draw with parallel sides this press tool does present some difficulty, but by incorporating slip-pieces the work in the foundry is absolutely straightforward.

Intricate Castings

In Fig. 8 is shown a flanged component (although the finished job had four large bosses set on the bottom ring which prevented it being finished by turning and made it costly to machine from solid metal). The top flange being only 0.060 in. prevented the making of a plaster pattern, for the reason that it would have been too delicate to handle, and a corebox could not be resorted to because the pattern was required "as per drawing." This decided the Author to use a low melting point metal, and the grade used can be melted in hot water, its melting point being 160 deg. F. This alloy expands very slightly on setting, and can be cast in clay, plasticine and wet plaster moulds. Used as a pattern material it is good for at least 500 off before appreciable wear is apparent, and one foundry produced 1,000 off from one of these patterns. To return to the flanged pattern, a mould had to be produced in plaster, and this was achieved by spinning up a core in two sections by using two strickles (Fig. 9). A turning was made with a template, then the top portion of plaster was shellaced and greased and another

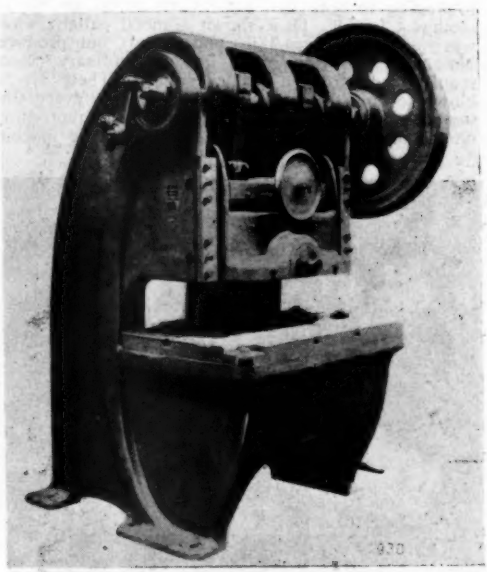


FIG. 4.—PRESS.

spinning made with a second template. This core was then carefully greased, as L.M.P. metals will not cast clean against shellac, so any surface coming in contact with the metal must be kept clean. On this core the component was turned by using a third template. To complete the work a three-piece mould was made over the three turnings, and after removal of the spinning made by the third template the mould was ready for the metal (Fig. 10). This sounds like an awful lot of template making and setting out, but it is only necessary to set out the complete work once, as the same piece of metal is used by cutting away in three stages.

Metal Spraying

Another very interesting subject to foundrymen in general is the spraying of almost any metal on to

Plaster, Plastics and L.M.P. Metals

almost any surface, be it wood, paper, plaster or metal, by means of a spray gun, much like spraying paint. The thickness of the coat that can be applied conveniently ranges upwards from 0.002 in. This method of applying metal is being used for building up worn coreboxes, patterns, whether they be in aluminium or gunmetal, and even engine and motor bearings. It is interesting to note that there is no shrinkage by this method. In Fig. 11 is shown a metal pattern which was not cast (as generally understood), but produced simply by spraying metal into an ordinary plaster mould made from a plaster pattern. There are no blowholes on this reproduction. Instead, every line, scratch and mark is faithfully shown and reproduced on the metal, and the surface itself needs no machining and no scraping. It is as perfect as the original pattern. What does this mean to the patternmaker and also the diemaker?

FIG. 5.—PUNCH AND CHANNEL. FIG. 6.—GROVED PULLEY. FIG. 7.—PRESS TOOL (FEMALE ONLY). FIG. 8.—FLANGED COMPONENT LOW MELTING POINT METAL. FIG. 9.—TURNING AND TEMPLATES. FIG. 10.—COMPLETE MOULD, ONE-THIRD REMOVED. FIG. 11.—SPRAYED PATTERN. FIG. 12.—PLASTIC PATTERN.

To the Author it means that there is no need to allow double shrinkage, machining or scraping, just a pattern, be it in clay, plaster or wood, exactly as required for the ramming machine. From this a plaster mould is made and a good plate is guaranteed. It may not even be necessary to make a pattern. In certain cases it should be possible to build the mould itself, either in wood or plaster, and thereby save the time and expense incurred by producing a pattern. What is there to prevent this method being used for making casting dies? One piece could be sprayed against the previous portion with perfect ease, and here again the pattern can be made of either wood, plaster or a low melting point metal just as described. This latter material produces a really good surface on the sprayed metal, and is the method favoured by the Author. When applicable and used in conjunction with plaster " stopping off " sections, diemaking by spraying is a practical proposition, but behind this example lies three years of solid research work by a firm of metal sprayers, and the Author is indebted to them for the trouble they have taken in producing this pattern. At the same time it should be stressed that this method is still in the research stages, but it is very well advanced.

The materials referred to include the thermo-hardening and acid-hardening phenol formaldehyde synthetic resin. It can be cast in moulds made of wood, lead or plaster with ease, and has a beautiful smooth bone-like surface. The chief characteristics are toughness, lightness (being 1/7th that of metal), and the ease with which it can be worked with the ordinary pattern-maker's tools. It can be turned, filled, drilled, tapped, and cut with the usual woodworking saws. Some may have had occasion to use one of the admirable stone compounds on the market, and one must grant they are hard, and a file or drill must be really good to make any impression at all, yet almost without exception they are very brittle. Cast resin simplifies some of the difficulties, and a medium-size plate pattern can be produced almost as quickly as in stone compounds.

Two plastic patterns (Fig. 12) of the same design were produced in plaster moulds. One (Fig. 11) was made in acid-hardening phenol formaldehide synthetic resin, whilst the other (Fig. 12) is thermo-hardening, and therefore requires the application of heat. The shrinkage on both these materials is 0.4 per cent., and they possess a compressive strength of 8,000 lbs. per sq. in. The density is about 1.2, as compared with 8.5 for steel, whilst the tensile strength is 6,000 to 9,000 lbs. per sq. in., compared with steel 200,000 lbs. per sq. in.

The resin, which is about the consistency of a syrup, can be obtained with or without a filler, but 25 to 30 per cent. of a filler, such as wood flour, hard plaster, etc., must be present. A small percentage of acid is added to the resin and thoroughly mixed together. The mixture is then poured into the mould and the acid hardening will harden in a few

hours, but the other material is allowed to stand for 30 min. to allow trapped air to escape, after which it is oven-cured at about 50 to 55 deg. C. for 2 to 8 hrs., according to size of pattern. After curing, the plaster mould is removed, generally by chipping it away, and when the back of the cast resin has been levelled off, the pattern is ready for use, as no cleaning up is necessary, although a rub over with water paper gives a very smooth surface.

Plastic Tools

Plastic tools, such as jigs, routing templates, drill jigs, and tinsmith's tapping blocks, press and stretching tools, are in continual use by the Vega Aircraft Corporation, and more than 200 such tools were produced by them within two months. In fact, they claim that the tooling of the B,17.F was carried out in three months, whereas 5 to 6 months would have been required without the use of cast synthetic resin.

Summary

To sum up, let us run through the materials mentioned, and point out their outstanding characteristics.

Temporary Patterns.—Plaster of paris must remain unchallenged as a medium for patterns where the number required does not exceed 6 off. There is no shrinkage with Italian fine plaster, but an expansion of about 0.3 per cent.

Semi-permanent.—Where the number of castings required is only a few hundred there is a choice of four materials, each having its own features:—

(1) Cast stone, which neither shrinks nor expands, and may be cast to very fine limits in plaster moulds. It is extremely hard.

(2) Low melting point alloys, which expand approximately 0.002 per in., and as can be seen by the sample, clean up to a fine surface when cast in plaster moulds. This is a good medium, but rather expensive.

(3) Cast synthetic resin is an ideal material, and considering the fact that 1 lb. of resin will fill 23 cub. in., it is not expensive. The only possible drawback is the slight shrinkage, but as can be seen by the resin block cast over a piece of metal, this shrinkage on a small object is negligible, as the metal will still fit back into the recess in the resin.

(4) Metal sprayed patterns at present are only available in simple forms, but it is going to be the most popular method of producing a semi-permanent or, in some cases, a permanent pattern, and by using a plaster that will expand to the same extent that the metal shrinks it should be possible to mould direct from a finished component.

Permanent patterns have not entered into the Author's purview. As produced at present they are good and expensive. His concern is to produce a reliable pattern cheaply and in the shortest time.

In closing, the Author would like to express his thanks to the hon. secretary, Mr. A. Hares, for his help and continued interest; also to Cafferata, Limited, for various data on plasters supplied from time to time, and to Metalisation, Limited, Dudley, for the examples of metal-sprayed patterns and moulds.

THERMAL LAG IN HEAT-TREATMENT OPERATIONS

(*Continued from page* 118.)

controlled atmosphere, and said that after the normal annealing they were reported to be hard. A cross section showed the hardness of the section to vary from 80 on one edge to 124 at the other. Re-annealing for half-an-hour evened up the material quite well. There was no variation in position so that the disparity must be attributed to thermal lag.

MR. PEACE said he was not familiar with the annealing of strip. The brass strip, he understood, was coiled, and he took it that there was only a very small space between the strip. He thought there was no question at all that they would get no convection of any importance upwards through the strip. The very narrow spaces would prevent gas or air flow. It was probable that there was a still and dead layer always present. It would therefore be necessary to rely entirely on the conduction of the metal for passing heat to all parts.

MR. H. G. HALL asked if Mr. Peace could deal briefly with the relation between the spacing of the cans and the area for combustion and circulation.

MR. J. J. SHEEHAN expressed incredulity as to the explanation given regarding the axle housing.

Can Spacing

MR. PEACE, in answer to Mr. Hall, said it was obvious that there must be some space between the cans; otherwise they might just as well build a can the size of the oven. With forced draught, where there was appreciable velocity of the gases, they could do with somewhat closer spacing than in the case of natural draught with somewhat lower velocities. If rectangular pots were used, 4 in. or possibly 6 in. between the pots would be reasonable. In the case of round pots there was plenty of space, but even when round pots were used he thought it undesirable to place them right up to each other. He considered it desirable to leave passages in all directions for flow across, as well as flow vertically. The advantage of round cans in providing the space was undoubtedly appreciable. Round cans were more readily produced as castings than square cans. That was a great advantage straight away, since the costs of annealing in the malleable trade were chiefly fuel and cans.

Atmosphere Control

Mr. Twigger having raised the question of atmosphere control for malleable cast-iron annealing, MR. PEACE said there was no doubt that this was the greatest advance made in malleable annealing for many years. It was used in the United States, and had been operated for some few years, but its use was confined to very few manufacturers. He thought the difficulty was the large capital outlay required for the plant. As furnace designers continued to work on the problem they would doubtless reduce costs, and he believed that this would become the conventional method of annealing for both blackheart and whiteheart malleable, though perhaps not in this decade.

STEWARTS AND LLOYDS

Developments involving the erection of new plant were announced at the annual meeting of Stewarts and Lloyds, Limited, by the chairman, Sir Allan Macdiarmid. He said that if they were to maintain their position in the front rank of the tube-makers of the world, they must spend large sums of money, first of all in deferred repairs; secondly, in alterations to existing plant; and, thirdly, in new developments. The board had approved a large amount of capital expenditure, most of which had already been sanctioned by the Government authorities on the ground of its immediate importance.

The chairman indicated that the expenditure covers, *inter alia*, one additional tube plant in Scotland and additions to the company's steelworks there to supply the necessary steel for this plant. In addition, considerable expenditure is planned on modernising existing tube plants in Scotland; an additional tube mill at Corby and open-hearth furnaces there to supply the necessary steel for it and other tube plants; alterations to the Hickman steelworks; developments at the Newport tube works in Monmouthshire, and additions to the spun-pipe plant capacity at Stanton. The directors do not propose, at the present time, to raise money by the issue of shares; they have come to a provisional arrangement with their bankers to borrow, when it becomes necessary to do so, subject to the consent of the Capital Issues Committee, up to a certain amount, with the intention of funding at a later date.

Sir Allan Macdiarmid commented on the price of coal, which, he said, in this country was considerably higher than in America. In their case it was an even more serious matter than it was for most other steelmakers in this country. Their blast furnaces at Corby, operating on low-grade Northamptonshire ore, required a relatively larger quantity of coke than blast furnaces which operated customarily on high-grade foreign ores. Further, the Bessemer steel-making process, as operated at Corby, used approximately 1 ton of pig-iron, in which the cost of coal was fully reflected, to make 1 ton of steel. This compared with the practice of the majority of other British steelmakers operating the open-hearth process and using approximately half as much pig-iron and a correspondingly greater quantity of scrap.

Outlining the company's achievements during the war period, the chairman said that from September, 1939, to the end of 1944 Stewarts and Lloyds produced 9,000,000 tons of coal. Their production of iron ore during the same period amounted to 33,000,000 tons. Pig-iron production during the period amounted to 7,500,000 tons, steel ingots of all qualities to 4,500,000 tons, steel tubes, fittings and specials to 2,500,000 tons and cast-iron pipes, specials and foundry products to 850,000 tons.

Apart from tubes in large tonnages for a variety of war purposes, the company produced more than 50 million steel forgings, and undertook the manufacture of many other weapons of war. The Stanton Company has also been engaged extensively in direct munitions production.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"GEOLITE"—Gear wheels for machinery. ST. GEORGE'S MANUFACTURING COMPANY, LIMITED, Lagoon Works, Arterial Road, St. Mary Cray, Kent.

"PHOSMELIZING"—Chemical compounds for use in the treatment of metal surfaces in the course of manufacture. PROTECTIVE METAL FINISHES, LIMITED, 1, Chalcot Square, London, N.W.1.

"HILLTOP" (in diamond device)—Rolled and cast building materials, furniture and cabinet fittings. HILL TOP FOUNDRY COMPANY, LIMITED, Anchor Works, Smith Road, Wednesbury, Staffs.

"CERROSAFE" and "CERROTRU"—Metals and alloys. CERRO DE PASCO COPPER CORPORATION, c/o Stevens, Langner, Parry & Rollinson, 5 to 9, Quality Court, Chancery Lane, London, W.C.2.

"SUVENEER"—Bi-metallic material in the form of sheets or strips. SUPERIOR STEEL CORPORATION, c/o Stevens, Langner, Parry & Rollinson, 5 to 9, Quality Court, Chancery Lane, London, W.C.2.

"DECMETIZED"—Chemical substances for use in the industrial treatment of metals to render them resistant to corrosion or erosion. PRODORITE, LIMITED, Eagle Works, Leabrook Road, Wednesbury, Staffs.

"PROMAGIN" AND "PROMEFIN"—Chemical compounds for use in the treatment of metal surfaces in the course of manufacture. PROTECTIVE METAL FINISHES, LIMITED, 1, Chalcot Square, London, N.W.1.

"VAPOCARB" AND "HOMOCARB"—Furnaces and chemical substances for use in the heat-treatment of metals. LEEDS & NORTHRUP COMPANY, c/o Integra Company, Limited, 183, Broad Street, Birmingham, 15.

[*Applications to the Cutlers' Company, Sheffield*]

"DRABALOY"—Metal alloys. DRABBLE & SANDERSON, LIMITED, Savile Street, Sheffield.

"VERTEX"—Air compressors, etc. PNEUMATIC COMPONENTS, LIMITED, 84, John Street, Sheffield, 2.

"DRABALOY"—Machine tools and hand tools. DRABBLE & SANDERSON, LIMITED, Savile Street, Sheffield.

"SPENLOY"—Tools for use in machine tools. WALTER SPENCER & COMPANY, LIMITED, Warren Street, Sheffield, 4.

PUBLICATION RECEIVED

"How to Repair Type 'A' Individually Screened Trailing Cables." Published by British Insulated Cables, Limited, Prescot, Lancs.

This is the first time the reviewer has seen a booklet devoted to the detailed carrying out of a technical job. Will some enlightened plumber follow it up with a description of wiping a joint? The explanations given are so well worded that it now appears that the job of repairing such a cable could be given to any intelligent operative.

SILICATE OF SODA is being advocated as an inhibitor for ferrous metals against corrosion attack.

THE MODERN PIG

IF YOU WANT...
clean iron, free from sand, free from sows ...uniform analysis... convenient size...easy handling... specify
STANTON MACHINE CAST PIG IRON

SPECIFICATION

WEIGHT	80-90 lbs.
Length	22 inches
Width	8½ inches
Thickness	3½ inches

(at notch 2½ inches).

Made in our well-known

STANTON, HOLWELL & RIXONS BRANDS

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

COLVILLES, LIMITED

WARTIME STEEL PRODUCTION

During the war years, Colvilles, Limited, have rolled over 9,000,000 tons of steel, it was disclosed at the company's annual meeting in Glasgow. Sir John Craig, the chairman, said that they had in their group the largest plate mill in Britain and a section mill which was at least equal to the largest in the country. The plate mill at Clydebridge had the European record for the greatest output of plates in one week. They produced thousands of tons of shell steel every week, and they were called upon to make the largest size of bombs required for aircraft, including 12,000 and 20,000-pounders. They rolled steel for the Bailey bridges and for the great floating harbour, sometimes known as "The Mulberry" and sometimes as "The Whale." Their subsidiary, Smith & McLean, Ltd., produced large quantities of sheets for Nissen huts and for the Anderson and Morrison shelters, as well as for bullet-proof helmets. At the Clyde Alloy Works, they were able to fulfil their promise to the Ministry of Aircraft Production by producing large quantities of the highest class of steel for aircraft. At those works they had the services of a new mill, which they had commenced to erect before the outbreak of war. That mill was the most modern of its type and, indeed, its capacity had proved greater than the demand, but it was well fitted to produce alloy steel bars economically, the steel being produced in electric furnaces both of the arc and high-frequency type.

Sir John Craig mentioned that in 1941 there was an acute shortage of plates and they entered into an arrangement with the Ministry of Supply to remodel one of the plate mills at the Blochairn works of the Steel Company of Scotland, Limited, to increase its capacity. The scheme involved an outlay of over £1,000,000 and was carried through with practically no stoppage of production. The cogging mill and plate mill at these works had been brought right up to date and they had proved thoroughly successful.

Pointing out that Smith & McLean, Limited, had an old-established business, founded 100 years ago, Sir John Craig said that their plant was capable of producing the largest sheet made in this country, but it must be admitted that the more modern continuous mill was a great advance on the old type of making sheets. They naturally had given this subject serious consideration. They felt, however, that with the many demands on the company's resources, it was in the best interests of the company that they should use the labour, capital and skill at their disposal in perfecting their present methods rather than in venturing in the meantime on a scheme of the magnitude of a new sheet mill.

ACCORDING TO AN AMERICAN SURVEY, 89 per cent. of the manufacturing plants in the United States can be reconverted to peacetime production within four weeks. This will give a higher employment figure than 1939.

CONTROL OF LABOUR

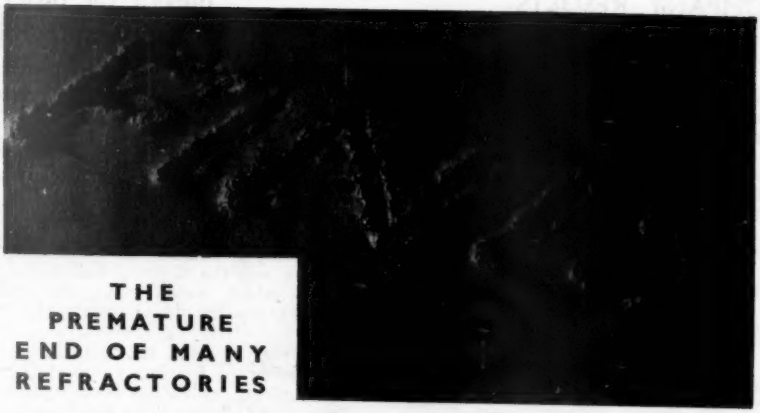
RELAXATIONS UNDER NEW ORDER

A Ministry of Labour Order, made by Mr. Bevin just before leaving office, substantially relaxes the control of the engagement of labour in accordance with the plan outlined in the White Paper on the control of industrial man-power in the period between the end of the war in Europe and the defeat of Japan. The overall effect of the Order is to restrict control of engagement to men in the age groups 18-50 inclusive and to women in the age groups 18-40 inclusive. The Essential Work Order remains in force to ensure the supply of three priorities:—(1) Supply of munitions for the war in the Far East; (2) housing, including the housing material industries; and (3) essential civilian industries. But the Ministry hopes that the power of direction can be left in the background and that the field of compulsion can be brought within very narrow limits. Direction will not be used so long as the new control of engagement Order smoothly effects the necessary re-allocation of labour. The machinery of control is in the provision that engagements of specified classes of persons may be made only through appointment offices, employment exchanges, or approved agencies.

Vacancies for managers are excepted as such, irrespective of the qualifications of the worker concerned. A manager is defined as "a salaried official in executive charge of a department, works, contract, or office," and the term will include superintendents or head foremen in charge of other foremen. Employment in "a professional, administrative, or executive capacity" in general covers all vacancies above the rank of foreman in a factory or supervisor in an office. The scarcity categories include professionally qualified engineers, chemists, metallurgists, and physicists. The Order enables a relaxation to be made in the detailed control of the men of military age through the individual deferment system. Employers will no longer be required to apply for deferment in order to retain the services of men born in 1914 or earlier.

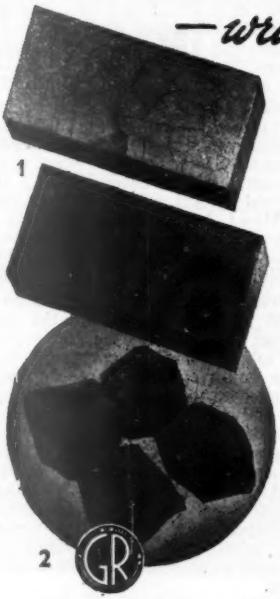
In factory practice the effect of the Order is that employers may not seek to engage any person within the restricted age groups for any employment other than excepted employments, but must notify particulars of the vacancy to a local office of the Ministry or an approved agency. Any person within the scope of the Order who wants work is not prevented from approaching an employer with a view to an engagement, but no engagement can be made except through an employment exchange or an approved agency.

MR. W. H. GARTSEN, senior partner in the firm of Henry Rogers, Sons & Company, metal merchants, of London, died recently at the age of 76. He was formerly associated with Ricard & Freiwald. The monthly tin statistics Mr. Gartsen published before the war were accepted as authoritative in all parts of the world.



THE PREMATURE END OF MANY REFRACTORIES

—written in Fireclay Joints



JOINTS are the weakest part of a furnace lining. Ordinary fireclay as a jointing material has certain fundamental disadvantages—it shrinks on drying and again on firing—the bricks do not remain bonded—and fireclay joints are readily attacked by slag. Durax No. 3 Refractory Cement for use with all types of fireclay bricks is a jointing material specially developed to overcome these serious disadvantages. It ensures the thinnest possible joints—sets hard without heat—and does not shrink during drying or firing.

Joints made with Durax No. 3 are as strong and as slag resistant as the fireclay bricks themselves. Its use ensures sound and homogeneous structures from which users can expect long life with a minimum of repairs. Full details on request.

DURAX No. 3 REFRACTORY CEMENT

NO SHRINKAGE. *Illustration (1) shows one firebrick coated with fireclay and the other with Durax No. 3. Both were allowed to dry at atmospheric temperature. The results are easily comparable in the photographic reproductions.*

STRENGTH. *Illustration (2) shows two test pieces allowed to dry at atmospheric temperature, and one fired to 1500°C. Tensile strength results — Unfired: 115 lbs. per sq. in. Fired: 912 lbs. per sq. in.*

FIREBRICKS. BASIC BRICKS
ACID-PROOF MATERIALS
CEMENTS. PLASTICS
INSULATION
SILICA BRICKS
SILLIMANITE. SANDS

General Refractories
LIMITED
HEAD OFFICE: GENEFAX HOUSE, SHEFFIELD, 10
TELEPHONE 31113 (6 LINES) 34.

COMPANY RESULTS

(Figures for previous year in brackets.)

Marshall Sons & Company—Interim dividend of 3¼% (same).

Park Gate Iron & Steel—Dividend of 8% (4% on larger capital).

Jury Holloware (Stevens)—Net profit, £13,073 (£11,125); dividend of 10% (same).

Arthur Lee & Sons—Interim dividend of 15%, less tax at 9s. 10½d. (same, less tax at 9s. 8.85d.).

Drakes—Net profit for 1944, £7,428 (£6,804); to special depreciation, £500 (£2,000); to reserve, £2,000 (£392); dividend of 7½% (same); forward, £16,168 (£15,891).

Mellor, Bromley & Company—Net profit, after taxation, for year ended February 28, £13,872 (£22,072); final dividend of 5%, making 10% (same); to reserve, £2,500 (£5,000); forward, £43,980 (£43,683).

Harland Engineering Company—Net profit for 1944, after providing for depreciation, taxation, deferred repairs, etc., £16,678 (£15,593); dividend on the ordinary shares of 7% (6%); forward, £14,800 (£13,996).

Mason & Burns—Profit to March 31 last, before taxation, £272 (£16,763); estimated surplus arising from E.P.T. deficiency claim, after making due provision for accruing income-tax liability, 1945-46, £2,577; dividend of 5% (20%).

Whessoe Foundry & Engineering—Net profit for year ended March 31, after taxation, £85,541 (£51,325); tax, £101,295 (£195,104); to reserve, £41,357 (£15,000); final dividend of 30%, making 40% (same); forward, £41,443 (£37,259).

Yorkshire Copper Works—Net profit for 1944, £71,155 (£68,179); dividend of 10% and bonus of 5% (same); to reserve for contingencies, etc., £5,000 (£10,000); to general reserve, £40,000 (£30,000); forward, £21,214 (£20,865).

BRITISH STEEL PRODUCERS' CONFERENCE

The new constitution of the British Iron and Steel Federation, which came into operation at the end of May, is based on membership by conferences representing manufacturers of the various products of the industry. Under the old constitution now superseded the Federation membership was composed of individual firms and affiliated associations.

The largest of the 13 conferences which now constitute the Federation is the British Steel Producers' Conference, comprising firms engaged in the heavy steel industry throughout the country.

The British Steel Producers' Conference have adopted a constitution and appointed as first chairman Mr. Ellis Hunter, deputy chairman and managing director of Dorman, Long & Company, Limited. Mr. N. H. Rollason, managing director of John Summers & Sons, Limited, is deputy chairman of the Conference.

NEWS IN BRIEF

THE BRITISH EXPORT TRADE RESEARCH ORGANISATION, the co-operative market research concern recently sponsored by a number of leading industrial companies and advertising agencies, has now been registered as a company limited by guarantee without share capital. The word "limited" is omitted from the title by Board of Trade licence. The registered address is Georgian House, Bury Street, St. James's, London, S.W.1.

MR. J. B. HARDIE, in an address recently to Scottish regional members of the National Federation of Manufacturing Engineers, announced that a member firm of the Federation had formed a new company which would bring an entirely new industry to Scotland. The company was the Scottish Switchgear & Equipment, Limited, which would make electrical fittings and switchgear and would ultimately give employment to some hundreds of workpeople.

FIVE BALL BEARING MANUFACTURING COMPANIES are associated in the Bearings Disposal Corporation, a private company which has been registered with £1,000 capital to act as agents for the Board of Trade in respect of the disposal of surplus Government stocks of bearings. The five companies are British Timken, Fischer Bearings, Hoffman Manufacturing, Ransome & Marles, and Skefko Ball Bearing. Each of these may nominate one director, as may also the Board of Trade.

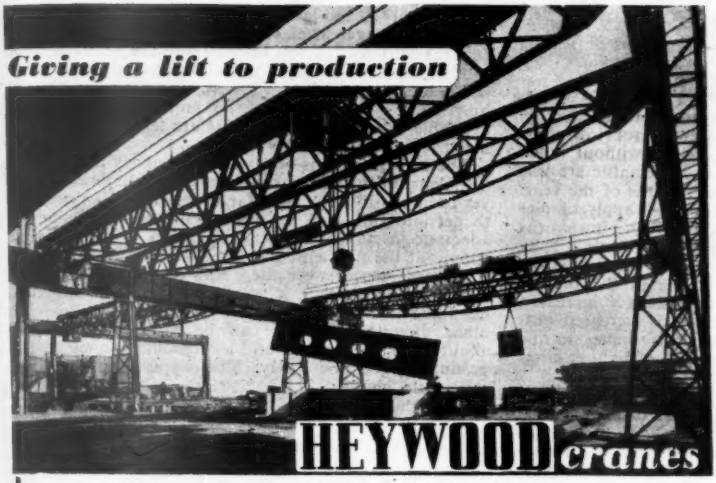
THE BOARD of the International Nickel Company of Canada, Limited, announces the formation of a delegate board of directors of the Mond Nickel Company, of which company International Nickel is the sole director and manager. Mr. D. Owen Evans, a vice-president of International Nickel, who had been delegate director of the Mond Nickel Company since 1929, will be chairman of the new delegate board, to which the following have been elected:—Mr. L. H. Cooper, Dr. W. T. Griffiths, Mr. A. P. Hague, and Mr. E. Pam.

THE RIVER WEAR COMMISSIONERS have drawn up a £3,675,000 plan for developing the port of Sunderland. The proposals include the making of another entrance to the South Docks and a new railway between the south end of the docks and the L.N.E.R. It is intended to widen and deepen the junction of the Hendon and Hudson Docks, while the River Wear will be widened below Laing's Shipyard and opposite the Corporation Quay. Twelve acres of land at Hendon and four at the South Inlet, which are to be reclaimed, will be used for timber storage. Other projects put forward are for the reconstruction of coal staiths, deepening of the harbour entrance with two new inner piers, new oil discharging berth, extensions to the Corporation Quay and the erection of a public cold store.

CONTRACT OPEN

Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Sidmouth, June 16—7,200 yds. of 10 in., 8 in., 6 in., 4 in. and 3 in. cast-iron spun pipes and specials, for the Urban District Council. The Engineer and Manager, Gasworks, Sidmouth.



These high speed 10 ton cranes have a change gear to enable loads up to 3 tons to be lifted even more readily. Their span of over 90 feet enables bulky fabricated steelwork to be handled with despatch.

ELECTRIC CRANES HEYWOOD'S REDDISH

S. H. HEYWOOD & CO. LTD., REDDISH, STOCKPORT, ENGLAND

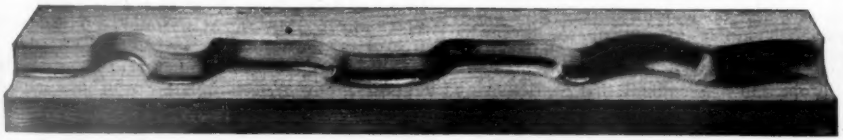
dm 1152

USE "PLASTIFIL" REGD. TRADE MARK

THE QUICK ACTION FILLET

REQUIRES NO GLUE.

TAKES THE SHARPEST CURVES.



SIZES $\frac{1}{16}$" TO $\frac{5}{8}$" EX STOCK.

BRITISH PATENT No. 508848.

SAMPLES ON REQUEST.

MADE BY

J. W. & C. J. PHILLIPS Ltd.

POMEROY STREET, NEW CROSS, LONDON, S.E.14

Also LEATHER FILLET, WOOD FILLET, PATTERN LETTERS, DOWELS, ETC.

Raw Material Markets

IRON AND STEEL

Deliveries of all grades of pig-iron are reasonably adequate for current needs. Licences for low-phosphorus and refined iron are obtainable without much difficulty, and restrictions in the use of hematite are less severe than they were in the earlier months of the year. Thus, if there be any anxieties about the supply of pig-iron it is at the light foundries, where high-phosphorus grades are required. Current outputs are certainly fully absorbed, and, as the makers have cleared almost the whole of their stock, they are unable in the present circumstances to respond to any inquiries for increased tonnages. The difficulties in the way of increased output are formidable, but those will have to be surmounted before the mass production of light castings for the post-war homes of Britain can be provided.

Steelmakers are devoting a large proportion of their productive resources to the manufacture of bars for the sheet trade, and consumption is unlikely to suffer any contraction throughout the summer months. As a consequence, the output of billets, blooms and slabs is on a smaller scale, and re-rollers maintain a steady pressure both for primes and defectives.

In the finished steel trade, there have been no spectacular changes. Busiest of all branches is the sheet trade, bookings being so extensive that there is little scope for the acceptance of further orders before the closing months of 1945. Mills engaged on railway and colliery material are also assured of a steady run throughout Period III, while the high activity of the producers of rolling stock assures steady support for the plate mills from these sources. On the other hand, the shipbuilders' specifications for plates and angles are well below the highest wartime levels, and, as both the heavy plate and section mills could handle much bigger tonnages than are at present on order, there is growing impatience for relaxation of some of the restrictions on the export trade.

NON-FERROUS METALS

There can be few developments in the tin situation while the Japanese continue to control so large a part of the world's supply. There will no doubt be some reduction in priority calls for tin now that fighting has ceased in Europe, but it is unlikely that restrictions on the use of the metal will be relaxed to any degree just yet. Stocks in the United States have been reduced considerably in the last five or six years, and while they are not at danger level, care must be exercised to ensure that they do not fall too low. There are believed to be moderate stocks of tin in this country, and similar considerations govern their disposal. At the same time, it may be expected that a little more tin will become available to users now that there are fewer war needs to meet.

The call for zinc is not on a particularly active scale. The demand for war purposes has fallen, and it has not yet been possible for manufacturers of civilian products to get into full working order. Supplies available are adequate to current needs. Lead, also, is in reasonable supply at the moment, but the situation might take on a different aspect were there any considerable increase in the demand. As it is, while the call from the building trade tends to grow, there is rather less activity in other directions. There can be no doubt, however, about openings for lead and lead products once civilian production gets under way. The copper situation shows very little change.

PERSONAL

THE HON. EDWARD JESSEL has been co-opted a member of the board of the Trussed Concrete Steel Company, Limited.

MR. F. S. CLARK has been appointed chairman of S.G.B. (Dudley), Limited, in place of MR. F. E. CLARK, who retains his seat on the board.

MR. LINCOLN EVANS has been appointed general secretary of the Iron and Steel Trades Confederation, to succeed Mr. John Brown when he retires early next year.

MR. J. A. AMSCHEL has retired from the board of Lightalloys, Limited, on account of ill-health. MR. CHARLES JOHN FEAR, secretary of the company, has been appointed in his stead.

MR. DONALD J. REESE, after three years on the staff of the [American] War Production Board, has rejoined the research and development department of the International Nickel Company.

MR. A. E. CHELL, M.I.Mech.E., has resigned his position as Joint Director of Iron Castings (Iron and Steel Control). MR. T. MAKEMSON is now solely in charge of the department as Director.

MR. DAVID GIBB, sales manager of R. & A. Main, Limited, Gothic Works, Falkirk, who has completed 57 years of continuous employment with the company, was honoured recently with gifts from the firm.

Alex. Findlay & Co. Ltd.
Structural Engineers, **Motherwell, Scotland**
Head Office: MOTHERWELL, N.B. *London Office*: 52/4, HIGH HOLBORN, W.C.1
Telegrams: { FINDLAY, MOTHERWELL. FINDLA, PHONE, LONDON. A.B.C. CODE 4th & 5th Editions.
STEEL BRIDGEWORK
BUILDINGS · ROOFS
GIRDERS · ETC.
Steel Pithead Frames
Steel Wagon Underframes
Speciality: **Stamped Steel Floor Troughing**